

Baby B'Air Flight Safety Vest

Background, Narrative and Safety Risk Assessment



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Background and Narrative

Avelo Airlines is seeking approval for and OpsSpec to allow to use of Baby B'Air in all phases of flight aboard Avelo Airlines aircraft. Approval of this OpsSpec is in the best interest of the traveling public, meets or exceeds all requirements or concerns, mitigates risk to lap children under two years of age and increases safety. Baby B'Air meets or exceeds all FAA and NTSB concerns and eliminates:

- Children as projectiles in the cabin
- The use of a restraining device raises the risk of crushing a child in a rapid deceleration
- Eliminates the risk of a care giver losing a grip on the child during violent vertical and horizontal acceleration events
- Eliminates a caregiver unfastening their seatbelt when the seatbelt sign is illuminated after takeoff or during descent

Baby B'Air produces a device that allows a parent to effectively restrain a lap child during all phases of flight. This device addresses shortcomings of traditional, earlier designs that tethered the child to a parent's or caregiver's breast, much like a baby carrier wrap and standard carriers which hold the child close to the vest. These types of devices increase the risk of an infant being crushed in the event of an accident or rapid deceleration. (See figures 1, 2 and 3.) Accordingly, the FAA has a requirement that children must be removed from these types of restraint devices during Taxi, Take-off and Landing.



Figure 1



Figure 2



Figure 3

In early 1983, the National Transportation Safety Board considered the safety problems posed for young children traveling in motor vehicles and aircraft and urged that a variety of actions be taken to promote increased use of child restraint systems. To reduce the risk of injuries caused by airline turbulence and rapid for deceleration events, the National Transportation Safety Board recommended improvements to restraining children which included the use of approved car seats.

Using a seatbelt across a child sitting on a caregivers laps creates an additional hazard to the child and could result in serious injury in a violent vertical (turbulence) event and puts the child in a position to be crushed in a horizontal deceleration event.

It is not always possible to hold a child securely on an adult's lap during turbulence and rapid forward deceleration events, with many events occurring without any warning to allow for adequate preparation, especially in clear air turbulence and mountain wave events. Among passengers, nearly all of those seriously injured during significant events are not wearing a seat belt, making restraining a key factor to reduce the risk and mitigating the startle factor.

Infants and toddlers under the age of 2 are not required to occupy their own seats or wear seat belts for takeoff and landing which most agree are the most critical phases of flight. Throughout the entire flight, these children remain unprotected and vertical and horizontal acceleration/deceleration events. Climb, enroute and descent turbulence-related accidents have occurred with children under the age of 2 in which caregivers have been unable to hold infants securely during turbulence encounters.

A 2017 report by American Academy of Pediatrics saw that 25% of injuries to lap children during flight was caused by falling from the seat due to being unrestrained. The authors noted that while children younger than 2 made up only 1% of passengers, they sustained 35% of pediatric injuries. The Academy has called for a federal requirement for restraint use for children on aircraft, including those younger than 2. The authors agreed that restraints may have prevented injuries from falls detailed in the study.

"By law, in the United States, an infant must be secured to a properly positioned safety seat with a 5-point restraint to ride in an automobile at 50 mph but is free to ride unrestrained on the lap of an adult inside an aircraft moving at speeds greater than 500 mph on a tridimensional trajectory and subjected to unexpected turbulence," they wrote.

The NTSB has said there have been no fatal injuries to lap children from turbulence, but there is "potential for a more severe outcome." It recommended the Federal Aviation Administration and airlines work to increase the use of child restraint systems and that the FAA study factors and challenges that affect caregivers' decisions about using child safety seats for children under age 2 on airlines.

For price-sensitive families traveling with children, the opportunity to avoid purchasing an additional seat is an appealing way to save money and many times, the decision to drive versus fly is around the financial costs.

Keeping seat belts fastened at all times while seated on a plane can reduce the risk of injuries, yet the most vulnerable, children under the age of two, are allowed to be unrestrained. Current FAA policy does not prohibit a parent from carrying an infant in their arms on board a commercial flight, and most, if not all, other scheduled airlines in the United States allow this practice. The FAA itself strongly encourages parents to purchase a seat for the child and placing them in a car seat, but stops short of mandating it. Additionally, the FAA has approved child restraint devices for children weighing greater than 22 pounds (the CARES device) but has not approved any device for use of infants or children who weigh less than 22 pounds.

Baby B'Air addresses all of the concerns and risks described above and meets all of the test elements to provide a safe and effective alternative that not only restrains a lap child by exceeding certification

limits, but places the child in the same position as if there were not restrained as a typical lap child being held in the arms of a caregiver. These include:

- Sudden and Unexpected Turbulence
- Aborted Take-off/Rapid Deceleration
- Rapid In-flight Decompression
- Emergency Landings
- Survivable Evacuations
- Falling out of a parents lap
- Emergency landing with a less than positive outcome
- Rapid deceleration

Baby B'Air provides an additional level of safety to a vulnerable lap child without the cumbersome process of using a car seat on a commercial flight, which is a determinate for many in a fly/drive decision (Figure 4). It also makes traveling easier for:

- Single parents or grandparents
- When traveling with more than one child
- Parents of twins
- Physically challenged parents
- When no extra seats are available
- Security screening process with infant



Figure 4

Comparing failure modes of current approved means of compliance reveals the following:

- Humans can “fail” between 2-3 G’s
- Car seats fail between 9-14 G’s
- Commercial aircraft seats are rated to fail 16 G’s

- The Baby B’Air has been successfully tested to 16 G’s

The Baby B’Air Flight Vest can prevent injury to lap children in all phases of flight caused by:

- Sudden, unexpected inflight turbulence
- Rapid inflight decompression
- Falling out of a parent’s lap
- Emergency landing or rapid deceleration

Allowing use of the Baby B’Air Flight Vests during Taxi, Takeoff and Landing will mitigate the following risks:

- Protect a child from a fall injury due to a rapid stop; sudden turn on the tarmac or at gate
- Keep a child with Parent in case of crash and expedite evacuation or rescue
- Provide an Equivalent Level of Safety provided to all other belted passengers on board

Initial Requirement of No Lap Children at Avelo Airlines

Airlines have a duty to keep all passengers safe onboard an airplane. Under that philosophy, Avelo Airlines began operations in late April, 2021 with a “no lap child” standard to protect those most vulnerable, children under the age of two. All Customers, no matter the age, must be mechanically restrained in all phases of flight, taxi takeoff, climb, cruise, descent and landing.

Operational data has shown that this standard has led to numerous customer service issues and operational challenges, outlined below. Given these events the status quo is not sustainable long-term and an alternative means of ensuring the safety of all customers must be determined.

Summary of Lap Child Issues at Avelo		
Issue	Root Cause	Impact
Customer confusion on CRS requirements	Avelo standard differs from industry norm	Negative customer service reviews, customers unprepared to properly secure child.
Above-average number of child seats on a flight due to customer demographics	No other way to secure an infant than with an FAA-approved child seat	Delays to flights as customers, flight attendants, airport ops Crewmembers all try to research if a seat is FAA approved and installed properly, which also leads to stress and frustration of the customer.

Customer compliance with Avelo standard	Avelo standard differs from industry norm	Customers become frustrated with requirements to fly Avelo versus most if not all other airlines which do not have a similar requirement.
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These issues highlight the need for a change to the way child restraint systems (CRS) are implemented at Avelo airlines and the alternative, children under two with no means of restraint other than the parent or caregiver. Given the demographic of customers that Avelo has flown since service start-up, and the fact that more family-oriented destinations (e.g., New Haven, Connecticut to Florida destinations) are planned, this issue will only increase in frequency and represented an unsustainable impact for the airline.

Given this fact, Avelo has two options:

1. Use technology or other products (Baby B'air) to create an equivalent level of safety or,
2. Remove the prohibition on infant-in arms customers on Avelo flights.

Avelo Airlines now allows the carriage of children in a parent's arms, the industry standard, but true to our highest core value of "Safety Always" is petitioning for and OpsSpec to allow the use of Baby B'Air in all phases of flight; taxi, takeoff, enroute, descent and landing. This will allow all children, regardless of age or weight, to have a restraint option other than purchasing a seat, raising the level of safety for all Avelo Airlines Customers in all phases of flight, ensuring the highest level of safety for the traveling public.

Baby B'Air Safety Risk Assessment

Mandating car seats at Avelo Airlines created additional issues:

- Children are out of their seat and unprotected for feeding, changing & consoling
- Parents cannot breast feed on descent to relieve ear blockages
- Car seats are bulky to carry and not compatible with disabled Customers
- High risk of car seats not installed properly, creating an additional hazard
- Car seats not tested over 30 M.P.H.
- Severely limited approved seat locations so as not to block egress
- In an actual evacuation, additional time to unbuckle the child's restraint to effect the evacuation
- Requires separate airline seat purchase

SRA Trigger

This SRA was initially triggered by the identification of hazards in the current system. The initial Avelo requirement of no lap children created undue stress on other parts of the operation that could lead to safety events as customers were delayed and frustrated with the boarding process.

Eliminating that requirement created risk to injury to children. The year 2012¹ saw numerous in-flight security events across the industry, and adding more stress to that creates the additional probability of

customer non-compliance. Additionally, delays and distractions during the pre-flight process increase the risk of a safety event as the crew attempts to make up for lost time.

Departments Affected

The following departments are affected by this SRA:

- Airport Operations
- Flight Operations
- In Flight Operations
- Customer Care / Reservations
- Marketing

System Analysis

The booking of an infant on Avelo starts with Marketing (via the company website) and requires the Airport Operations Crewmembers and the Flight Attendants to ensure the process is executed properly.

Operating Environment

This process is primarily executed in the aircraft itself, as the customer with the infant is boarding the flight and securing themselves and the child for departure. Given the dense seating arrangement and need to board up to 189 customers, this can make the boarding process straining for a parent attempting to installing a car seat properly and then securing their child.

Hazard Matrix

Given the assumption that the current state was not sustainable, the following hazard matrix shows the hazards with the proposed solutions and their risk ranking in accordance with the Avelo SMS Risk Matrix.

Current State

Issue	Risk	Reason
Operational Delays, Confusion on CRS usage on Avelo Flights.	C3 – Minor	System deficiencies leading to poor dependability or disruption.
Customer satisfaction when travelling with infants and needing an extra seat.	C2 – Low	Isolated media/brand events when customers become frustrated with current Avelo standard.
Customer safety – infant safety when encountering events (turbulence, RTOs, etc.)	B1 – Very Low	Infants not allowed in arms on Avelo, reducing risk to ALARP. Any changes will change this ranking.
Overall Risk Ranking:		C3 – Minor

Currently given the operational issues that can occur as a result of customer disruptions with CRS knowledge, installing car seats, and Avelo's standards went beyond FAA guidance gives a C3 – Low risk rating.

Future State

ID #	Issue	Option 1 (Baby B'air)	Risk	Option 2 (Remove requirement)	Risk
1	Car seat is burdensome and bulky to install on aircraft	Use of Baby B'air device for all stages of flight. Allows parent to secure infant directly to their seatbelt	3A – Low In the event of an accident, there is still risk of injury, however it is much lower.	Align Avelo standards with industry norms and not require separate seats or restraints for infants.	5A – Minor History has shown that unrestrained infants can pose a danger to the infant and other customers
2	Confusion on restraint requirements for infants	Work with Avelo marketing to ensure that all customers are aware of products to enable easier options for securing infant.	B2 – Low Providing a solution and reason why Avelo doesn't allow infant-in-arms during the booking process will better prepare customers for flight	Provide better guidance on the website for why Avelo does not allow infant-in-arms, and enforce the standard.	C4 – Moderate Customers will become frustrated with the Avelo standard. Additionally, a review of current non-FAA approved CRS devices finds that there is widespread non-compliance in enforcing the use of CRS devices across the industry by other airlines.
3	Infant protection in event of sudden declaration (e.g., RTO)	Baby B'air device is rated for 16 G's and attaches to the parent's seat belt.	3A – Low A child secured to the parent's seat belt will not become detached during an emergency event.	Infant would be held by parent's arm strength.	B5 – Moderate Sudden deceleration would result in loss of parent's control of the child, causing injury or death to the child or other customers that the child comes in contact with.
4	Clear-air turbulence	Baby B'air device is rated for 16 G's and attaches to the parent's seat belt.	3A – Low Ease of use of the device allows for infant to be positively secured for the duration of the flight.	Infant would be held by parent's arm strength.	C5 – High Sudden, unexpected turbulence may exceed the parent's ability to secure the child, resulting in impact with the ceiling resulting in significant injury or death.
5	Customer support for parents with Infants	Baby B'air devices can be stored on the aircraft or at stations to support any customers who may not have known about the requirements	B1 – Very Low Any customer issues could quickly be addressed by station or F/As.	Remind customers of requirements, deny boarding to those that cannot comply.	C3 – Minor Customers whose travel plans have been disruptive can file complaints, post negative feedback regarding Avelo to local media/social media
Overall risk rating:			B2 – Low		C5 – High

Overall, implementation of the Baby B'air Device represents a low risk to the company and to the under two child. This compares to a higher risk for aligning Avelo with the industry norms around infants-in-arms.

Baby B'Air Mitigation Plans

Currently, Baby B'Air can be used and is allowed during the enroute portion of flight. Once the captain turns off the seatbelt sign, the caregiver can release his or her seatbelt and tether the child with Baby B'Air. The seatbelt sign is on to mitigate risk to the caregiver and as such, should not be released when the seatbelt sign is illuminated. At the same time, we have a child who is sitting on a lap of a caregiver, not necessarily held tightly, exposed, and vulnerable to a startle event.

System Risk Analysis

Risk is probability over severity. The addition of allowing the use of Baby B'Air's device to Avelo Airlines in all phases of flight would be overall extremely low-risk, especially when compared to the other hazards a lap child is exposed to while traveling untethered. Industry data of injuries caused by other hazards far outweigh crushing events, which are zero.

The last fatal hull loss in the United States occurred in February, 2009. Since that time, the United States air system has carried more than 8 billion passengers, more than the population of the world. The fatal event that did occur was a rapid decompression. A lap child in the vicinity of the rupture would have been immediately sucked out of the breach area.

This is also highlighted with United Airlines Flight 232 in Sioux City, IA. As the plane prepared for an emergency landing at Sioux City's airport, flight attendants prepared passengers for a crash landing. Parents of lap children were told to wrap them in blankets, place them on the floor and hold them with their hands and feet. No parent's hands or legs were strong enough to withstand the G-forces of the catapulting aircraft. One lap child somehow landed inside an overhead luggage bin and was rescued. One child did not survive although his mother and everyone around him survived. Chances are his fate would have been very different if FAA regulations had required him to be properly restrained during this very critical event.

Risk to a lap child is also to other known factors and not only to a crushing event. The NTSB added a safety recommendation to the FAA on its "List of Most Wanted Safety Improvements" in May 1999, suggesting a requirement for children under two years old to be safely restrained.

Any time there is a change to a system or process the chances for unintended outcomes increases. To ensure that this does not happen, the following mitigation strategies would be undertaken in the event that Avelo is approved via an OpsSpec to move forward with the allowing Baby B'Air to be used in all phases of flight.

Crewmember awareness and training

Currently most Crewmembers of Avelo are unfamiliar with Baby B'Air and are only trained in the requirements for CRS as they exist in the Avelo standards today. Once a policy has been updated to

allow the use of Baby B'Air, training shall be commenced for Airport Operations and In-Flight Crewmembers to educate them on the device, and why Child Restraint System devices are so important. It would also be recommended that Flight Attendants either receive hands-on training with the device or view a specific CBT, so that they can better assist customers who may have issues securing the device on the aircraft.

Customer awareness

To ensure higher compliance with the CRS requirements at Avelo, Customer Service / Marketing shall improve the overall branding surrounding the Baby B'Air device. This will allow customers to make better informed choices when booking travel on Avelo and can come to the airport prepared.

Part of this awareness campaign will require educating the contact centers on the device so that they can better direct any questions or issues a customer may have during their travel experience. Helping the customer understand why, in addition to providing solutions, these requirements exist at Avelo will help ensure a higher level of buy-in from the customer and reduce the likelihood of a negative customer experience on-board the flight. Across the airline industry there are events where a frustrated customer can escalate into an in-flight security event or an unruly customer, which can pose a significant safety risk to the Flight Attendants.

Regulatory Approval

Currently the Baby B'Air Flight Safety Vest device is not approved for use during taxi, takeoff, or landing. The FAA has not certified any device for use as a CRS on infants during these phases of flights. As stated earlier, risk to a lap child using the Baby B'Air Flight Safety Vest is to other known factors and not to a crushing event, no more so than with a caregiver holding a child on their lap.

Although the Baby B'Air Flight Safety Vest is approved for inflight use, asking a care giver to release their seatbelts right after takeoff or just before landing creates a hazard and is intentional non-compliance to the seatbelt sign. Asking a care giver to wait until the seatbelt sign is off, with it being illuminated because of safety concerns, introduces a hazard to the lap child who is not restrained.

A cursory review of customer feedback to similar devices to Baby B'Air for sale through retailers such as Amazon.com show a significant number of airline customers (on airlines other than Avelo) where the Flight Attendants either do not check to see that a device is FAA certified or look the other way; allowing customers to use these devices for all phases of flight. This represents a normalization of deviance that has occurred in the airline industry regarding child restraint systems.

Avelo intends to work with the FAA at all levels to ensure that Flight Attendants and customers comply with the spirit and intent of the FAA's regulations as written. Doing so will reduce any potential for intentional non-compliance with the regulations, and also allow the FAA to conduct proper oversight of the Baby B'Air system to ensure the highest level of safety for the customer.

Safety Assurance

Bringing the Baby B'Air device into Avelo represents the creation of a new series of processes within the airline. These processes will be subject to oversight from the Internal Evaluation Program. Audits will be updated to ensure that elements of the Baby B'Air CRS are checked.

Additionally, the Avelo Safety Department will monitor safety reporting for reports indicating a process, equipment, or training shortcoming related to Baby B'Air. In the event such a shortcoming is found, it will be addressed through the Avelo SMS process. Other data streams, such as the Flight Attendant ERC, Customer Feedback, Voluntary Self-Disclosures, and Operational Data will also be monitored to ensure continued performance of this system.

Hazard Owner

Since this SRA touches multiple departments, **Greg Baden, Chief Operating Officer**, is the hazard owner. The following departments all have ownership in ensuring the product is used appropriately:

- Airport Operations
- Flight Operations
- In Flight Operations
- Customer Care / Reservations
- Marketing
- Safety

A steering committee will be set up with representatives for each department to ensure a smooth and effective implementation of this process. Safety will monitor the process for effectiveness of the implementations plans and the mitigations mentioned in this SRA.